Mobile telephone-operated video telesurveillance device, operating method, application and telesurveillance network

The present invention concerns a mobile telephone-operated video telesurveillance device as well as an operating method, applications as well as a public telesurveillance network. It enables remote surveillance with a stand-alone decision-making process in relation to a video environment captured by the mobile telephone. It may be implemented in professional fields, for instance safety of premises, road conditions and in particular climate or traffic conditions (speed of vehicles, jumping traffic lights), as well as in private fields, for instance surveillance of a toddler, surveillance of a swimming-pool or other systems in a residence.

As technologies evolve, the video surveillance is taking over in more and numerous fields. The multiplicity of the devices for each application brings about more and more sophisticated network mechanism.

A video surveillance device contains a camera, an analysis and diagnostic means of video pictures based on the application, and a means for communicating the alarms and programming the device.

In parallel, the telephone becomes more and more perfected, after having fulfilled for a long time its primary function as a remote sound link, it has become mobile and integrates today visual communication, shot by a camera and visualised on a flat screen.

The telephone operators are seeking continuously for new uses of the mobile telephone and the latter becomes a video game companion which may be disturbed occasionally

by an SMS and sound communication has now been placed in the background.

It is thus that in the application EP0 884 905 concerning a production process of a picture to be transmitted over a terminal, it has been suggested using a telephone with a camera comprising a shape recognition means enabling to localise the user's face for transmission. In the application EP1 170 953 concerning a mobile telephone, remote surveillance system, mobile information terminal and method of use, remote surveillance has been suggested, by transmitting pictures in relation to a transmission authorisation signal preventing third parties from accessing the picture. Such methods and devices are however under the user's control for the operation thereof and the transmission of pictures.

The purpose of the present invention is to create a video surveillance device from a telephone possessing visual communication means by the integration of a picture analysis module having its own diagnostic and dialogue processing unit with, at the input to the module, reading the video signal issued from the camera and, at output, a link to the control member of the telephone in order to enable activation/ deactivation and stand-alone operation of said telephone.

Besides, methods and devices are known, which enable to locate objects in a picture. Some of them suggest statistic analysis of the points or pixels of a digital video signal issued from an observation system for the realisation of efficient devices liable to operate in real-time.

More recently, it has been suggested to realise such devices by the association of information processing units of similar nature each addressing a particular parameter

extracted from the video signal for the analysis thereof. It is the case of the patent applications of Monsieur Patrick PIRIM, inventor: FR96/09420 (tracking a moving zone), FR96/09420 and FR98/00378 (monitoring a driver's vigilance), FR98/16679 and WO99/00425 (compression system), WO98/05383 (picture processing), FR00/02355 (automatic perception), FR01/02539 filed on 23 February 2001 (tracking an object), FR01/02530 (adaptation), FR01/10750 (processing system), FR02/10067 (visual perception), FR02/10066 (analysis), FR02/10065 (functional unit), FR02/10064 (dynamic recruiting) as well as their extensions whereof in particular WO98/05002, WO98/05383, WO99/36894, WO99/36893, WO00/11610, WO00/11609, WO00/13420, WO01/63557 or the article "The vision mechanism is integrated on a single chip" in Electronique, June 2000 N°104 wherein the implementation of histogram calculation and processing blocks or units or modules, such terms being here equivalent, is suggested, forming true electronic Space-Time-division Neurons, so-called STN, each analysing a parameter, said parameter being processed by a function ($f_o g$) to generate individually an output value. Such output values, altogether, form a feedback available on a bus for usage in the blocks during the analysis. At the same time, each of these histogram calculation and processing units constitutes and updates an analysis output register providing with statistic information on the corresponding parameter. The selection of the parameter analysed by each histogram calculation and processing block, the content of the analysis output register as well as the function ($f_o g$) that it fulfils, are determined by a software executed in an API (Application Program Interface).

There is explained that each STN unit may fulfil automatic classification, anticipation and learning functions.

In a histogram calculation and processing unit as described in WO01/63557, for a given parameter, several elements are determined from the histogram calculated and stored in a memory, i.e. the maximum RMAX of the histogram, the position of said maximum POSRMAX, a number of points NBPTS of the histogram. Also classification milestones are also determined, which enable to delineate an interest zone for the parameter and it has been suggested to consider as a criterion for the determination of the milestones, a ratio of the maximum of the histogram, for instance RMAX/2, and to obtain the milestones by scanning the data of the memory since the origin, searching for zone limits corresponding to the criterion.

An application of the STN blocks is more particularly detailed in the application FR-01/02539 where it has been suggested to break down hierarchically the object to be tracked according to its properties which enables, for instance, to determine first of all the overall contour of a moving object relative to relatively stable background, then look inside said contour for characteristic elements by their tone, their colour, their relative position... Such an analysis enables rapid elaboration of multiple applications involving tracking an object. Such applications may be developed, either from a prior formalisation having outlined the significant characteristics of the object, or, thanks to a learning function by examining a scene wherein the object in question is present, the device itself enabling to extract characteristic parameters of the object. Below, the term element or object

will be used interchangeably regarding what should be tracked in a scene of the environment.

The invention suggesting integrating to a mobile telephone possessing sensors of an environment, in particular of a sound and picture environment, a module enabling analysis of the signals issued from the sensors and to conduct a diagnostic before making a decision. This decision-making process may be an absence of action in particular in case of negative diagnostic or one or several actions in case of positive diagnostic (for example recognising and exceeding a parameter threshold of an element of a scene). The analysis consists in extracting and measuring element parameters significant of the environment. For instance, if the analysis must bear upon a face: recognising the face within the scene then, in the face, recognising the eyes, the mouth then, possibly, within these elements of the face, determine significant sub-elements: eyelid, pupil or lips... The diagnostic consists in determining or detecting the existence of particular elements of a scene and/or exceeded parameter thresholds linked with an element in the scene. Within the context of the invention, the term scene covers anything which is captured by a sensor, for a camera, it is a series of pictures, for a microphone, sounds, for a temperature sensor a temperature measurement... and the corresponding element may for instance be a moving object/human in the pictures, sounds of a particular frequency range and/or a duration and/or a sound intensity, temperature as such.

The invention concerns therefore a mobile telephone-operated video telesurveillance device, the telephone comprising a transmitter and a receiver operated by a control member for connection to a telephone network, the telephone

comprising means for capturing sound signals BFm and video signals Vc by dint of a microphone outputting the sound signals BFm and of a camera outputting the video signals Vc of video pictures and, on the other hand, receiving and reproducing sound signals BFe and video signals Ve intended for, respectively, a sound reproduction means and of a video reproduction screen, the telephone comprising a user input interface and a stand-alone power supply source.

According to the invention, the telephone includes moreover an analysis and diagnostic module of at least video pictures fitted with a memory for storing at least one telesurveillance application program, an input to said module being connected to the output of the camera and receiving the video signals Vc, the module being connected by at least one output with the control member for sending at least one diagnostic datum D to said control member in relation to the analysis and to the diagnostic of the video signal by a calculation means programmed by an application program of said module, the diagnostic data D being instructions acting upon the control member.

Within the framework of the invention, the term video for the analysis module concerns fixed or animated pictures as well as sounds and concerns more generally which is called commonly multimedia.

In various embodiments of the invention, the following means, taken individually or in combination, are employed:

- the camera is a camcorder,
- the camera is of the CCD-type (load transfer) or CMOS,
- the program memory of the analysis and diagnostic module is preloaded by the application program (the program is available at the onset)

- the application program is downloaded in the program memory of the analysis and diagnostic module,
- the application program includes at least one call number on the network,
- the application program includes at least one computer call address on the network,
- the analysis and diagnostic module receives moreover at input the sound signals BFm and the module generates diagnostic data D also in relation to the analysis and to the diagnostic of the sound signals,
- the instructions acting upon the control member are one or several actions selected by no way of limitation among the following list:

waking up telephone members in standby,
placing telephone members in standby,
calling a number over the network,
transmitting recorded sounds,
live transmission of sounds,
transmission of a short message (in particular SMS),
transmission of a live video sequence,
transmission of a recorded video sequence,
transmission of a video analysis,
transmission of a video diagnostic,
transmission of multimedia compatible data for INTERNET,
dialogue between the telephone and the number called,
in case of using a positioning peripheral, controlling said peripheral via positioning instructions from the network,
end of call,

- the analysis and diagnostic module includes a reprogrammable memory for the program of the calculation means,

- the analysis and diagnostic module receives moreover digital data D from the control member and the program of the calculation means comes from the network and is transferred into the reprogrammable memory in the form of digital data D,

- the analysis and diagnostic module receives moreover digital data D from the control member, the telephone comprising moreover a chip card reader legible by the control member and the program of the calculation means comes from the chip card and is transferred into the reprogrammable memory in the form of digital data D,

- the analysis and diagnostic module includes a video picture acquisition and memorisation module and a sound detection means for interfacing with the video and sound signals, a digital signal processor or micro-processor-type calculation means, the memory for the application program and a dialogue unit for interfacing with the control member,

- the analysis and diagnostic module includes at least one spatial and time-division processing unit and a set of histogram calculation units whereof the material and functional configuration depends on the application program,

- the analysis and diagnostic module is a block IP which may be integrated (materially and/or functionally) into an electronic circuit,

- the electronic circuit is an electronic component,

- the electronic component is an integrated circuit comprising one/several telephone functions (component with one/several usual functions in telephony: for instance transmission, reception, signal processing, signalling...) of the telephone,

- the telephone is arranged on a positioning peripheral enabling at least to direct said telephone in space according to positioning instructions (OM) issued from the telephone, said positioning instructions being generated by the analysis and diagnostic module,

- the positioning peripheral includes a first bracket wherein the telephone is arranged, the first bracket being itself arranged in a second bracket, the first and the second bracket being articulated together by at least one motor operated by a control circuit receiving the positioning instructions (OM),

- the second bracket includes two motors whereof both rotors are laid out along two axes substantially perpendicular to one another, the control circuit and a charger intended for recharging the stand-alone power supply source of the telephone,

- the positioning peripheral of said telephone enables moreover to move in space said telephone according to positioning instructions (OM),

- moreover, positioning instructions transit over the network,

- the positioning instructions (OM) are transmitted to the positioning peripheral device by dint of a telephone connector comprising a series data transmission link,

- the telephone includes one or several of the following sensors whereof the output is connected to the analysis and diagnostic module, said module analysing and diagnosing the measurements of said sensors:

  - angular position sensor,
  - acceleration sensor,
  - speed sensor,
  - temperature sensor,
  - luminosity sensor,

- barometric pressure sensor, (possible use as a burglar alarm: the opening of a door causing a pressure wave in premises),
- biometric sensor (fingerprints, ADN...),
- the sensors of the telephone are connected to the telephone by dint of a telephone connector comprising a series data transmission link.

The invention also concerns therefore a positioning peripheral compatible with the telephone of the invention and enabling at least to direct said telephone in space according to positioning instructions (OM) issued from the telephone, said positioning instructions being generated by the analysis and diagnostic module.

The invention also concerns an operating method which derives from the implementation of the device as described previously according to all its possibilities and which is an operating method of a mobile telephone-operated video telesurveillance device, the telephone comprising a transmitter and a receiver operated by a control member for connection to a telephone network, whereas the telephone can, on the one hand, capture and transmit sound signals BFm and video signals Vc issued respectively from a microphone generating the sound signals BFm and from a camera generating the video signals Vc of video pictures and, on the other hand, receiving and reproducing sound signals BFe and video signals Ve intended for, respectively, a sound reproduction means and a video reproduction screen, the telephone comprising a user input interface and a stand-alone power supply source, wherein pictures issued from the camera are transmitted to a receiving apparatus connected to the network and which can visualise the video pictures,

wherein a device is implemented according to any of the previous features individually or in combination and wherein the telephone includes moreover an analysis and diagnostic module of at least video pictures, fitted with a memory for the storage of a telesurveillance application program, an input to said module being connected to the output of the camera and receiving the video signals Vc, the module being connected by at least one output with the control member for sending at least one diagnostic datum D to said control member in relation to a decision resulting from the analysis and the diagnostic of the video signal by a calculation means programmed by an application program of said module, the diagnostic data D being instructions acting upon the control member and in that the connection to the receiving apparatus results from the decision generated by the analysis and diagnostic module.

According to variations of the method, the receiver is a mobile or fixed telephone and/or the receiver is a computerised means capable of visualising multimedia compatible data for INTERNET, a server connected over the network and arranged between the telephone and the receiver providing the interface between the telephone data and the INTERNET network.

The invention also concerns a particular application of the previous operating method wherein a toddler is monitored remotely, the application program enabling at least the analysis and the diagnostic of the toddler's movements and the connection to the receiver when movements are diagnosed.

The invention concerns finally a public telesurveillance network which is composed of a mobile phone network

comprising a transmission exchange, over such network, application telesurveillance programs for a telephone-operated video telesurveillance device, programmes which may be downloaded by said telephones.

The mobile telephone of the invention includes therefore stand-alone decision-making means in relation to the analysis and to the diagnostic of an environmental context (pictures, sounds or others) captured by the sensors of the telephone and may therefore of its own initiative decide to alert compatible remote equipment (conventional or specialised telephone, for instance the equipment used by the firemen, the police and the surveillance exchanges or computerised means): the decision-making process unfurls automatically. Moreover, the analysis and the diagnostic being dependant on an application program, the analysis and diagnostic parameters may be suited to the application contemplated and, preferably, by reprogrammable means and in particular by transmission over the telephone network of the program to the telephone of the invention or by inserting in the telephone a chip card containing the program which is then transferred to the analysis and diagnostic module of the telephone.

This decision-making process unfurling upstream, at the source of the environment, the downstream user is relieved from the surveillance tasks and, moreover, the network is freed, the connection and transmission being initiated only according to the result of a diagnostic.

The use of this method renders the video surveillance market most casual, and the notion of associated services becomes predominant. On top of the fact that the mobile telephone only uses the network for the transmission of digital data, diagnostic data (alarm and type of alarm for instance)

and/or video data in relation to the analysis and to the diagnostic of a video environment, typically preloaded or downloaded application programs, from the downloading transmission exchange, which reduces the weight of the telesurveillance on the network as regards the pass-band volume, fine analysis of the picture by elaborated visual perception may enable moreover to compress the video information to be transmitted.

It should be noted finally that, within the framework of the invention, the mobile telephone may be intended for a public network as well as a private network, for instance within a company or a fixed or mobile building. Besides, the implementation of a mobile telephone is considered preferably since the former, further to its development, is now relatively cheap to produce and its modification for adaptation of an analysis and diagnostic module should only increase the production cost marginally. However, the invention is more generally applicable to means for radiocommunications of sounds, video (pictures) and network data developed specifically to that end.

The present invention will now be exemplified in relation to:

Figure 1 which represents a video mobile telephone of the state of the art,

Figure 2 which represents a mobile telephone according to the invention with an analysis and diagnostic module,

Figure 3 which represents an analysis and diagnostic module realised with conventional calculation means,

Figure 4 which represents an analysis and diagnostic module realised with space-time-division neuron-type calculations means,

Figure 5 which represents an application example of the telephone of the invention,

Figure 6 which represents the schematic material structure of a second application example of the telephone of the invention, and

Figure 7 which represents a telephone in this second application example of the invention.

Figure 1 represents a simplified flow chart of a mobile telephone 1 integrating visual communication, corresponding to the previous art. This telephone includes a basic core with a transmitter 2 and a receiver 4 operated by a control member 8. Moreover, to enable an interaction with the user, control interface means 9 at input with a keyboard and/or voice recognition are connected by an electronic bus Tc to the control member 8. On the basic core are connected at input, a microphone 3 sending a low-frequency voice signal BFm and a video signal Vc issued from a camera 6 of the telephone 1. On the basic core are also connected at output, a headset 5 or a loudspeaker for sound diffusion of a signal BFe issued from the receiver 4, as well as a video screen 7 which may reproduce video data Ve received, stored in the telephone or captured by the camera 6 of the telephone as well. In addition to the reproduction role of the video screen 7, said screen, as control interface means at output, may also enable interaction with the user by displaying menus or others. It is also possible in certain versions that the sound reproduction means, in particular headset 5, form a control interface means at output by diffusing instructions or sound menus. The telephone 1 being mobile, a stand-alone power supply source is integrated to said telephone. The functional representation of the mobile telephone on Figure 1 being very schematised by reason of

simplification, all the elements of the telephone have not been represented in detail, such as the hardware safety means (chip card) and software safety means (encoding/decoding programs) or network management and communication means (network searching programs, network connection programs...).

Figure 2 enables to visualise how the invention applies extremely simply to a state-of-the-art telephone. Indeed, the invention consists roughly in incorporating in a mobile telephone of the type which has been described in relation to Figure 1, an analysis and diagnostic module video 20. This module receives at input at least the video signal Vc issued from the camera 6 of the mobile telephone 1. In an enhanced version, the module 20 may receive moreover the voice signal BFm issued from the microphone 3. At output the module 20 is connected by a digital link D to the control member 8 in order to transfer diagnostic data thereto. It will be observed at later stage that the module 20 may also take into account certain functions from the control member and, for instance, the compression of data, in particular video data. It may be noted that the link D is indicated as bi-directional and it will be seen that the module 20 may also receive digital data issued from the control member and, for instance programming data, in particular the application program, for the analysis and the diagnostic issued in particular from the network and received by the mobile telephone 1. Indeed, the invention may be implemented within a network structure wherein a supervisor/controller operator provides means of communication (among which gates between computer-based and telephone networks) and of management (in particular transmission of application programs enabling the analysis

and the video/audio diagnostic in the module of the telephone, the programs of the module being downloaded) between users of the telesurveillance device.

In other embodiments, the analysis and diagnostic module is an additional entity protected in particular by the copyright and/or by semi-conductor topography and/or patent rights and/or other sui generis rights, which is qualified as a block IP (or virtual component which represents knowledge linked with the design of functions which may be incorporated into integrated circuits), and which is integrated within a component with conventional telephone functions: the entity is added in a component or circuit used conventionally in telephony (functionally by adding a program and/or materially by adding a functional hardware block of logic gates and/or mixed by configuration or reconfiguration of a programmable structure of logic gates or combination of program and hardware). The blocks IP are functional entities now widely used for the realisation of integrated circuits and they correspond to hardware objects (gate structures for instance) or software objects (instructions) or a combination of both. The blocks IP enable the creation of function libraries wherein the designers of integrated circuits may dig for the realisation of specific circuits. With reference to the previous example, the set of blocks IP intended for the telephony is added a block IP corresponding to the analysis and diagnostic module to realise an integrated circuit intended for the realisation of a telephone according to the invention.

Preferably, the analysis and diagnostic module is a single integrated circuit, possibly associated with external memory, which is arranged in a telephone with conventional video means. The addition of such an integrated circuit may

take place very simply with minimum modification of the extant circuits of the telephone. In particular, the link of the module to the control member may be made by connection to a communication bus from the control member which is generally implemented within mobile telephones to control peripheral members (transmitter, receiver, keyboard, screen...).

Figure 3 represents the organisation of the picture analysis and sound detection module 20 according to a first embodiment using computerised calculation means, conventional calculator, in particular a digital signal processor (DSP) or a micro-processor. The video signal Vc derived from the camera 6 enters the video picture acquisition and memorisation sub-assembly 21. The sound electric signal BFm derived from the microphone 3 enters the sound detection sub-assembly 22. A calculator 23 runs the application program(s) 25 which enables (enable) to analyse and to perform a diagnostic on the picture and the sound for time-division duration, i.e. a preset time range. This (these) application program(s) may have already been stored in the telephone and/or preloaded and/or downloaded from the network. In relation to the diagnostic resulting from the analysis, and in particular in case of non-conformity with diagnostic criteria, a digital signal D compatible with the control member 8 is generated by a dialogue unit 24. This digital signal D, which corresponds to actions in particular on the network connection means of the telephone, may be the transmission with a preset number on the network of an appropriate message (SMS) with visualisation of the scene recorded and/or live.

The means implemented in this embodiment of Figure 3 are particularly greedy of electric energy and, preferably, the analysis and diagnostic means are used in relation to the Figure 4 with space-time-division neurons (STN) which are particularly adapted to these functions and particularly flexible to use (re-organisation and re-use of the neurons in relation to the depth of analysis and/or of the application), and this has relatively reduced energy cost. Said means may also be used for purposed of video compression as seen in the presentation of the state of the art in the first part of the description.

Figure 4 represents a preferred embodiment with space-time-division neurons (STN) including by way of example a set of sixteen polyvalent (or space-time-division neurons, these terms being equivalent) histogram units or modules in the form of a generic visual perception processor (GVPP) 20' which forms the analysis and diagnostic module with space-time-division neurons. This processor includes moreover a sound detection means 22 acting directly on an electronic processor 23 itself in relation with a dialogue interface or unit 24 by a bi-directional bus D to and from the control member 8.

These histogram calculation units form a matrix, they are connected to a bus 56 whereon the parameters DMVT (direction of the movement), VMVT (speed of the movement), L (light), T (tone), S (saturation), p0, p1, p2,..., p15 are available (p0, p1, p2,..., p15 are slopes of reference axes produced by the unit 54). The bus 57 carries the feedback information. Such a processor is in particular described in the following publications FR-2.611.063 and WO-98/05002.

This perception processor 20' implements a spatial and time-division processing unit 53 which, receiving a video-type signal, produces a

certain number of parameters for each pixel. They may be for instance the speed (VMVT), the direction (DMVT), a time constant and a binary validation parameter on top of a delayed video signal and the different frame, line and pixel synchronisation signals. In such a device, the interest of constituting histograms of these parameters enabling the constitution, the manipulation and the exploitation of statistical information have been emphasised. The purpose of this type of picture processing device is to provide at output a signal which carries for each pixel a piece of information significant of the result of the application of recognition or selection criteria according to classification. These criteria are predefined or elaborated by the picture processing methods and devices properly speaking. In this same document WO-98/05002, a set of calculation modules STN enabling to calculate histograms is described in relation to the spatial and time-division processing unit 53. Each module STN 51_{a00} ... 51_{a33} receives data over a data bus 56 and is interconnected to the others by a feedback bus 57 transporting results after classification. An application programming interface software API enables to set up, relative to one another, the operating modules and parameters of the perception processor by dint of a material and functional configuration bus 55. This software API, as well as the application program 25, is managed by the electronic processor 23 which is in relation with the set of the modules STN by the bus 55 which also returns the calculation results of the modules STN. The whole processor GVPP is therefore controlled by the electronic processor or control unit 23, of the micro-controller type, which determines in relation to an application program 25 those of the parameters DMVT, VMVT, L, T, S, p0, p1, p2,..., p15 which are processed at a given time by a unit STN or a dedicated group of polyvalent histogram units and according to initialisation (INIT), writing (WRITE) and end (END) signals produced by a sequencer 52.

Each histogram calculation unit is connected to a data bus 56 which supplies the different parameters to be processed, and a feedback bus 57 which provides the classification signal of each neuron STN and the learning function signals to the different other neurone STN. Each histogram calculation unit includes a memory, a classifier and a feedback unit. Each unit 1a is liable to have automatic anticipation and learning classification functions.

The generic visual perception processor (GVPP) 520 thus formed may be integrated on a single semi-conducting substrate. The number of polyvalent histogram calculation units depends on the application and the manufacturing technologies of semi-conducting components available.

It has been seen that it was possible to implement the invention either using essentially software means operating in generic calculation circuits such as a central processing unit or a digital signal processor (DSP) as that used in relation to Figure 3, or using essentially hardware means with one/several dedicated circuits in wired logic or in adaptable/ programmable logic as the circuit GVPP shown in relation to Figure 4 with its STN modules. It can be understood that such a distinction of means is not absolute since software means need hardware means to operate and that the adaptation/programming of the dedicated circuits may resort to the software. Thus, even in the case of the dedicated circuit of Figure 4, an electronic processor 23 has been implemented which enables to supervise the structural and functional operation of said dedicated circuit. Moreover, these techniques may be combined, whereas a portion of the analysis process might involve a dedicated circuit and another a generic central unit. The means implemented by the invention are therefore both hardware and software, since the latter term may be taken in the sense of program but also structuring instructions of hardware means as in the case of configuration instructions of logic circuits with programmable operational structure (networks of

programmable logic gates, in particular VHDL – high density logic gate circuits – within ASIC).

In these diverse possibilities of realisation, the means implemented enable continuous sequencing (real-time) of the pictures of a scene issued from the sensor (camera, CCD, CMOS) with sub-sequencing of each of the pictures received, this temporally and spatially. Each pixel (point of the picture) is known by its value P relative to the luminance and/or chrominance and its instant position (i, j, t) where i and j define the spatial position within the picture matrix and t the sequence or the time. The consecutive values of P are processed in the time-division field (in a time-division processing unit in the case of a dedicated circuit GVPP) for extracting parameters linked with each of the pixels, said parameters being selected among the luminance, the tone, the saturation, the direction of the movement, the speed of the movement, the orientation of edges, the curvature of edges, etc. and the respective positions i,j of the sequence t are processed spatially (in a spatial processing unit in the case of a dedicated circuit GVPP) in order to determine spatial orientations. The information thus obtained will be analysed statistically and hierarchically in order to perceive the elements forming the pictures and to reach a diagnostic. Thus, in the case of a dedicated circuit GVPP, a dynamic recruiting process of the modules STN will be implemented during the various sequences to enable active perception of the elements of the picture, the recruitment taking place relative to given objectives and in particular whether the type of element liable to be in the picture is known beforehand (a face) or not (generic perceptive analysis). On the basis of the perception, a diagnostic process is implemented before making action-oriented decisions, in particular on the control member, such as, for instance, the activation of the telephone and the envoi of a short message (SMS) by the telephone when an element perceived and diagnosed as a face appears in the picture.

Figure 5 represents an example application of video surveillance of a sleeping toddler 103 with parents who make a point of being alerted remotely when said toddler wakes up. Any movement 101 of the baby and/or sound captured by the camera and/or the microphone of the telephone 110 are analysed and a diagnostic is carried out thanks to the application program, by the mobile telephone 110 of the invention which has been arranged so that it perceives the scene 102 by its camera and its microphone, and transmits 121 an alarm and the scene by dint reception means 122 and 123 of the telephone network 120 to a second mobile telephone 130 of the parents and corresponding to the call number requested by the diagnostic portion of the application.

The second telephone 130 which may be a conventional mobile telephone, enables to visualise the scene by a screen 131 and to listen to the sounds by a sound reproduction means 132. The second telephone 130 may be a fixed telephone with or without video means and, in the latter case, the alarm and the sound of the baby only will be received. The second telephone 130 may be replaced with micro-computer-type means with wire or radio link or, even a mobile telephone-computer, and in particular by dint of the computer network INTERNET which enables the transmission of multimedia data including pictures and sounds. In the latter case, an INTERNET server will interface within the network 120 between the telephone of the invention 110 and the computer means replacing the conventional mobile telephone 130.

More generally, the telephone of the invention may also be applied to the surveillance of a flat or of a building, of a vehicle for instance in the case of fire, theft or other, of a

swimming-pool within the framework of drowning prevention thanks to sound detection (a body falling in the water, rippling water) and pictures : mass moving or not at the surface or depth of the liquid.

The telephone of the invention may also find an application in teleconference and, for instance, be centred automatically round a speaker whereof the lips are moving, the GVPP analysing the faces and portions of face (eyes, mouth...) and the diagnostic being programmed for detecting the movement of the portion of face corresponding to the lips according to an anthropomorphic model.

By changing the application program, it is possible to modify the video surveillance function, for instance in a vehicle, recognise the owner or the people entitled to drive said vehicle, the alarm is transmitted to an addressee which may be a safety authority in case of non-recognition and it is then recorded and instructions are given to the vehicle accordingly. Surveillance applications of the automotive traffic on roads or motorways are also possible thanks to the means for determining the speed of the perception elements enabled by the GVPP : fluidity measurement and automatic alarm or detecting when the authorised speed has been exceeded and transmitting an alarm to means for repressing road violence.

In relation to the application, the receiver station of the alarm (130) may for instance also be a enhanced telephone such as firemen or police or surveillance exchange. Thus, the receiving apparatus may be a specific device.

Other applications are possible as will now be seen in relation with Figure 6 where the telephone of the invention enables to control, in relation to the analysis and to the video and/or audio diagnostic, a positioning peripheral device

instead of said telephone. The position of the telephone may concern the orientation of the shot (whereas the telephone may rotate around itself to direct the camera in a given direction), the telephone then remaining in a given location. The position may also concern in combination or non with the orientation, the selection of the location in space of the telephone, whereas the latter may move in said space. These possibilities depend on the positioning peripheral implemented, from a single rotary bracket which may be controlled according to one or two axes, a mobile device travelling on a surface (controlled motorised cart), let alone in a three-dimensional space (airship, aircraft or sub-marine controlled as a reduced-scale model). It can be understood that the positioning notion is relative and that if it is generally the telephone of the invention which is positioned in a fixed space (is directed or moved in space for obtaining a direction and/or origin with a different viewing point), the case is contemplated when the space moves and the aim is to keep a direction and/or origin with constant viewing point. The latter case may, for instance, correspond to an automated beacon with video telephone located at the front of a ship liable to be roll or pitch and intended to prevent any collision by video detection of obstacles : the analysis and diagnostic module is then configured to detect floating bodies ahead of the ship towards the horizon.

The adaptation of the telephone with video means of the invention to such an application is relatively simple since in most cases, the mobile telephone possesses a connector intended for power recharging and data exchanges (generally by a series link) between the control member and external peripherals. Figure 6 represents under the general reference

1 a telephone as that of Figure 2 with a linking connector 101 for recharging the power supply 10 by the line V and for data exchange communication by the link OM represented here as unidirectional exchange from the control member outwardly but which enables more generally bi-directional data exchanges.

The telephone 1 is positioned stably in a first bracket 100. This first bracket 100 is itself arranged in a second bracket 106 in a steerable fashion angularly by control positioning means, the second bracket being assumed as arranged on a fixed location of the space in this version. The telephone 1 is hence fixed with respect to the first bracket 100 and the first bracket 100 may be oriented angularly with respect to the second bracket 106. Consequently, the telephone and hence the shooting direction of a picture may be oriented angularly in space. The bracket system presented enables thus to keep, to direct according to positioning instructions and, accessorily, to supply (recharge) the telephone 1.

The controlled positioning means comprise a control circuit of motors 103 acting upon two motors 104 and 105 by motor control signals CM. One of the motors referenced as 105 is fixed immobilised by its stator on the second bracket 106 and its rotor drives the stator of the other motor referenced as 104 whereof the rotor is fixed to the first bracket 100. The line V and the link OM of the connector 101 reach the second bracket 106 through the first bracket 100. The second bracket 106 includes a charger 102 (to recharge the telephone 1) receiving an external power supply, in particular mains from the public electric distribution network, and which enables, moreover, power supply of the controlled

positioning means (control circuit 103 and motors 104 and 105). The positioning instructions issued from the control member 8 of the telephone 1 and acting upon the control circuit 103 are carried by the link OM. The initial source of the positioning instructions is preferably the analysis and diagnostic module which uses the link D towards the control member (for example following of a person or a face). It is however possible to transmit over the telephone, from of the telephone network, such positioning instructions which are then received by the receiver 4 of the telephone 1 and sent by the link OM by dint of the control member 8. In the latter case, the orientation may for instance be obtained from another telephone while depressing its keys or, if using computer means, in particular INTERNET, if moving one/several display cursors (mouse) of a computer terminal on the telephone network with computer gateway.

The line V and the link OM are preferably materialised, in particular by a wire link, possibly by or associating one or several rotary contacts (the first and the second bracket being mobile relative to one another). In a more enhanced version, the line V and the link OM are de-materialised, for instance an electromagnetic induction means enabling to recharge the power supply unit 10 of the telephone and the link OM taking place over radio waves (for example BLUETOOTH®), the second bracket comprising then moreover compatible radiocommunications means connected to the motor control circuit 103.

Preferably, the rotors of the motors are shifted by 90° to enable efficient scanning of the shooting space. Preferably there will a maximum angular bottoming, i.e. 360°, for the plane in space where the scene picture elements are most

likely to be found. For instance for a telephone arranged on a table in a room, it is preferable to scan, for horizontally shooting, the whole room (360°) where a person is more likely to be found than on the ceiling. On the other hand, due to mechanical constraints, in particular the presence of the brackets, there are zones where shooting is impossible.

It goes without saying that the possibilities of angular space scanning from the viewing point are adapted relative to the needs and the implementation cost. Thus, if two motors have been represented on Figure 6, which enables volume space scanning, in a simplified version, a single motor may be implemented, preferably, enabling scanning in a plane where the picture elements are most likely to be found.

The motors are preferably stepping motors. An indexing means (for locating the origin position) may be implemented either directly on the rotors, or, in a more complex fashion, by analysing pictures. The indexing means enables to know a reference position from which it is possible to determine the displacement (number of steps for stepping motors, which corresponds to an angular displacement which can be calculated). The indexing means, in a variation, may send a signal back to the telephone 1 over the bi-directional link OM. The positioning interface may also include other sensors such as for instance positioning sensors, in particular angular, speed and/or acceleration, battery level or power supply sensors... whereof the information is sent back to the telephone.

Figure 7 enables to visualise the arrangement of the telephone 1 of the invention in the first bracket 100, itself in the second bracket 106. In the resting position, the telephone 1 is substantially vertical and the shooting means of the

telephone has a shooting axis substantially horizontal. Thanks to the motor 105, the first bracket 100 may rotate with respect to the second bracket 106 enabling the shooting axis to scan space in substantially horizontal plane. The motor 104, for its own part, enables to toggle the first bracket 100 with respect to the second bracket 106, i.e. to enable the telephone 1 leaving its substantially vertical position for positions close to the horizontal, whereas the shooting axis moves up and down and conversely.

As indicated for Figures 6 and 7, it has been assumed that the second bracket is arranged at a fixed location in space. However, in other variations of the invention, the telephone 1 may be made mobile in space by using one/several brackets which possess means to move in said space. In such cases, it appears preferable that the external power supply is not connected permanently, unless it has reduced displacement radius (the length of the external power supply cord) and a stand-alone power supply means, in particular of rechargeable battery type, is implemented in the mobile bracket of the telephone. In such a version, the simplest version with rolling means, the device of Figures 7 and 8 includes moreover on the internal face of the second bracket taxiing and directional means controlled by dint of the link OM. In another variation, the telephone 1 may be arranged substantially vertically on a supporting cart comprising driving and directional wheels (an additional controlled toggling means of the telephone which may be implemented). It appears that the controlled means of displacement on the ground (possibly another referential one) are adapted to the uses contemplated, as well as simple rolling means (wheels, caterpillar) or articulated legs, suction

devices... Similarly if displacement in a three-dimensional space is requested, the displacement means will be suited to said space. Conventional robotics management tools may be usefully implemented in such applications.

As indicated previously and thanks to the possibility of hardware and functional configuration of the modules STN of the GVPP in relation to an application program by dint of the API, it is also possible to use the perception processor as a video picture compression system as described in FR98/16679 and WO99/00425 in order to improve the quality and the fluidity of the pictures transmitted over the telephone 1, 110, whereas a higher volume of compressed information may be transmitted over the transmission channel. Thus, after a diagnostic leading to a positive decision causing a connection to the network, the perception processor may be reconfigured to operate in video compression. It may be understood that in such a case, the receiving means 130 and/or the server network in case when INTERNET is used as a link with the remote apparatus 130, compatible decoding means will be placed therein. In such a case, a connection between two telephones of the invention is particularly interesting since they both include processor perception means which are compatible and configurable for compression/decompression.

It is obvious that the invention may be applied in divers fashions and in particular as regards the diagnostics based on the analyses which may produce actions of various types: simple alarms, transmission of computer messages, transmission of video and/or sound data, possibly multimedia to various pieces of equipment of telephone, possibly computer, type, by dint of a radio-telephone network to which

the mobile telephone of the invention is connected. The applications of the invention are also multiple, for private or family surveillance with a conventional video mobile telephone comprising the analysis and diagnostic module as well as for professional applications and in this case, the telephone of the invention may be a specific realisation, in particular ruggedized mobile telephone or in the form of an industrial module. These applications may in particular derive from inventions implementing space-time-division neurons and described in the applications whereof the inventor is Monsieur PIRIM and which are in particular listed in the first portion of the description.